

EVALUATION OF THREE INSTRUCTIONAL METHODS OF TEACHING FOR UNDERGRADUATE MEDICAL STUDENTS, AT KING SAUD UNIVERSITY, SAUDI ARABIA

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المقدمة: هناك توجه عالمي لتغيير المنهج التقليدي في التدريس إلى المنهج الذي يركز على المتعلم بطريقة حل المشكلة. وهذا المنهج مع مميزاته المتعددة يحتاج إلى عدد أكبر من أعضاء هيئة التدريس إضافة إلى وجود مكان متسع.

تهدف هذه الدراسة إلى مقارنة ثلاث طرق في التدريس وهي التعليم المعتمد على حل المشكلة والمحاضرات إضافة إلى التعليم المعتمد على حل المشكلة المعدل.

طريقة الدراسة: تمت الدراسة بمشاركة 33 طالباً في السنة الرابعة بكلية الطب أثناء دورة الرعاية الصحية الأولية حيث تم توزيع الطلبة إلى ثلاث مجموعات وتم تطبيق الطرق الثلاث المختلفة بمشاركة ثلاثة من أعضاء هيئة التدريس وتمت مقارنة المجموعات الثلاث مع بعضها أثناء الدورة وبعدها. العناصر الأساسية التي تم تقييمها هي قدرة الطالب على استرجاع المعلومات ومهارات حل المشكلة إضافة إلى مدى الإلمام بالموضوع.

نتائج الدراسة: في التقييم الأولي كان هناك فرق ذو دلالة إحصائية لصالح التعليم المعتمد على حل المشكلة الأساسي والمعدل بالنسبة للإلمام بالموضوع ومهارات حل المشكلة ولم يكن هناك فرق في المرحلة الثانية للتقييم. كما أن 39 % من الطلبة يفضلون التعلم بطريقة التعليم المعتمد على حل المشكلة المعدل ثم الأساسي (36 %) ثم المحاضرات في المرتبة الأخيرة (25 %).

الخلاصة: تعتبر هذه الدراسة بعضاً من مميزات التعليم المعتمد على حل المشكلة الأساسي والمعدل مقارنة بالمحاضرات ولكن هناك حاجة لعمل الدراسة على نطاق واسع لدراسة هذا الخيار للتعليم.

الكلمات المرجعية: الطرق الإرشادية , المحاضرات , التعليم المبني على حل المشكلة الأساسي والمعدل , المملكة العربية السعودية

Background: There is an international move from traditional curriculum towards the learner – centered, and patient-oriented curriculum. In spite of its advantages, problem-based learning requires a larger number of teaching staff and space. This study was done to compare the problem-based learning (PBL), lectures and modified PBL methods.

Methods: Thirty-three fifth year medical students who were taking the Family Medicine rotation participated in the study at the College of Medicine, King Saud University. Three instructors participated in the teaching of three topics to the three groups of students. Students acted as control for themselves across the three instructional methods, namely; lectures, PBL and modified PBL. The main outcomes were students' recall of knowledge, problem solving skills and topic comprehension.

Results: In the initial assessment, there was a significant difference in favor of PBL and the modified PBL regarding comprehension of the topic as tested by the short answer questions ($p = 0.0001$), problem solving skills as tested by the modified essay question ($p = 0.002$). Non-

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significant results were observed at the second stage of assessment. The modified PBL method was the preferred one for 39% of the students, followed by the PBL (36%) and lastly the lectures (25%).

Conclusion: *This empirical study suggests some advantages for the PBL method and the modified PBL over the lecture method. Larger studies are needed to confirm our results of this important issue as the modified PBL is an affordable option for schools that can not meet the staff and space requirements of the PBL curriculum.*

Key Words: *Instructional methods, lectures, modified PBL, PBL, Saudi Arabia.*

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INTRODUCTION

There has been a sudden increase in the number of medical schools in Saudi Arabia in order to meet the manpower requirements. The development of a national strategy that meets the special circumstances of the Kingdom is necessary. The traditional curricula used in medical schools are over-loaded with so much information, that students' creative and problem solving skills are inhibited.¹ The lecture format is the most frequently used style of teaching of these curricula. Lectures are advantageous particularly for the introduction of new topics or subjects and more economic for teaching large numbers of students.² Furthermore, because rapid advances in science quickly make some information obsolete and irrelevant to practice. The detailed knowledge of basic sciences divorced from clinical application is usually outmoded by the time they come to practice medicine. Burner, for example, advocates the presentation of realistic problems and allowing students to discover for themselves what to learn from them.^{3,4}

What is most important and relevant to the student's future role is what should be included in the curriculum, which should also aim at preparing students to be life-long learners, able to cope with stress as well as unexpected changes, and able to manage their learning effectively. The core curriculum with the optional electives should focus on the knowledge and competencies needed by the students as first year residents.⁵

It has been found in a systematic review of continuing medical education that the lecture method of instruction is ineffective in changing physicians' behavior. Performance in terms of prescribing rates, lab/x-ray utilization procedures do not change.⁶ Many educational pioneers are working to make large class lectures small by systematically creating occasions for students to

spend more time together in active, meaningful learning and thinking situations.⁷ Problem based learning (PBL) is a good example of the attempt to integrate the basic and clinical sciences, and many medical schools have reported their approaches to construct more vertically integrated or 'patient-oriented' curricula.³

Problem-based learning was implemented at McMaster University in the mid-1960,⁸ and by 1991, nearly 100 medical schools in the United States were using some form of the PBL approach.⁹

PBL curriculum has been defined by Barrows as "encountering the problem first, problem-solving with clinical reasoning skills, and identifying learning needs in an interactive process, self-study, applying newly-gained knowledge to the problem and summarizing what has been learned".⁹ The implementation of PBL curriculum would help independent learning and problem-solving. It has been reported that, although students taught with PBL curriculum do not perform as well as those taught in conventional curriculum in basic sciences tests, they usually perform better in clinical examinations.¹¹ Two randomized controlled trials of traditional and PBL methods of teaching basic pharmacology,¹² and epidemiology¹³ showed no significant difference in the performance on quizzes, multiple-choice questions (MCQ) or examinations between PBL and traditional students, but the PBL group reported a stronger grasp of epidemiology principles, enjoyed working with a group and were more enthusiastic at the end of the course. In the trial on pharmacology course,¹² the exam results revealed similar scores for both traditional and PBL groups with PBL students performing slightly better in the category of short essay questions. Furthermore, the study reported positive effects of PBL in terms of the use of additional learning

resources, interdisciplinary team work and learning fun.¹² It has been noticed that, students taught using the PBL method were less likely to study for short-term recall and were likely to study in order to understand or analyze what they need to know for a given task and develop an adequate cognitive scaffolding. From the student's view point, the PBL curriculum is more enjoyable than the conventional curriculum.^{11,13,14} The PBL graduates felt their skills at independent learning, problem-solving and data gathering skills, in gathering information in behavioral science and dealing with socio-emotional problems of the patients were better.¹

The PBL method requires a larger number of staff to deal with small groups. The problem is more acute in developing countries where the classes are large, with over 100 students. It also requires more resources (additional audiovisual equipments, classrooms ... etc). Teachers need to acquire PBL skills of instruction. The medical school at King Saud University (KSU) has around 300 students in each batch. Consequently, the staff/student contact time has to be increased if the PBL method is to be adopted. Therefore, we decided to try the modified PBL that does not require extra hours of work by staff. This study was conducted with the objective of comparing the three instructional methods namely PBL, modified PBL and lectures. The outcome measures used were: the student recall of knowledge, problem solving skills and topic comprehension.

Course Description

During the last two years of their studies, medical students at KSU have six clinical rotations, including a six-week attachment in Family Medicine (FM). The FM course is presented six times per year for groups of about 30-35 students. Students spend five clinical sessions per week at KSU affiliated health centers, which is their only exposure to community-based training. The rest of the week is spent at lectures, tutorials and small group discussions.¹⁵ Instructional methods were shifted from the mainly lecture format to a mixture of group discussions and interactive lectures.¹⁵

METHODOLOGY

Thirty-three fifth year medical students of KSU who were taking the FM rotation were the study subjects. The students were divided into three groups of eleven students each. Three instructors

participated, each teaching one of the topics namely: back pain, headache and obesity (Table 1). In the first session, the lecture method was used to teach all the topics. Group-I was instructed on back pain, group-II on headache and group-III on obesity. In the second and third sessions, the students were taught by means of the modified PBL and PBL consecutively. The instructors were requested to put an equal emphasis on all the three formats of the core competencies of the topics, particularly those to be tested in the evaluation after the sessions. The students acted as controls for themselves in the three groups. There was no guarantee that all other influencing factors would be kept constant.

Table 1: Students' distribution into three groups, topics and instructional methods

Group	1 st Session Lecture format	2 nd Session Modified PBL	3 rd Session PBL format
Group-I	Back pain	Obesity	Headache
Group-II	Headache	Back pain	Obesity
Group-III	Obesity	Headache	Back pain

In the PBL method, for each small group, a 30-minute stimulus session was conducted during which clinical cases were discussed first and then students' learning issues identified and student tasks subsequently distributed. One week after the session, the small group discussion was conducted. In the modified PBL method, a stimulus session was not conducted. Instead, patient scenarios and questions relating to the topic to be taught were provided a week earlier. Suggested reading materials, along with the patient scenario were also given. The students were asked to read on the topic in the light of the patient scenario and come prepared to the session. This method differs from the traditional lecture method by being more interactive and by encouraging student participation.

The assessment was conducted using an instrument consisting of (i) five MCQs to test students' knowledge; (ii) five short answers questions to test comprehension; and (iii) 3-5 Modified Essay Questions (MEQ) based on clinical management vignette questions which test students' decision making ability. A sample of questions used in the instrument is given (Appendix 1).

Assessment was conducted immediately after each session and two weeks later. Furthermore, the instructors' and students' views on these three

methods, their feelings, attitudes and perceptions of the efficacy of these methods were explored. The same process of assessment was repeated two weeks after the encounter. Students were further asked about the preferred method for instruction.

Statistical Analysis

Mean values of quantitative variables across the three instructional methods were compared using a one-way analysis of variance, and then Duncan's multiple range test¹⁶ was used to compare the pair means. The analysis was carried out using SPSS PC 12.0 statistical software.

RESULTS

The mean scores of each of the evaluation tests on the different teaching methods were compared. On the initial assessment, there was a statistically significant difference between the three methods and scores regarding the short answer question scores ($p = 0.0001$) and modified essay question (MEQ) scores ($p = 0.002$). By using Duncan's multiple range test, we have found that the mean scores of the short answers, MEQ, obtained using the PBL teaching methods, were significantly higher than those of the lecture method but not significantly different from the modified PBL method. There was no statistically significant difference among the three instructional methods for the MCQ score ($p = 0.155$) (Table 2).

When, the scores of the three instructional methods in the second assessment (two weeks later) were compared, statistically significant difference on short answer questions test was observed ($p = 0.002$). The scores were significantly higher for the PBL group compared

with the lecture group but not different from the modified method group. On the other hand, there was no significant difference among the mean scores of MCQ and MEQ tests across the three instructional methods (Table 3).

In the second assessment, it was observed that, there was a consistent decline in the mean scores of all the tests, across the three methods when compared with that of the first assessment. The proportion of students who ranked the modified PBL method as the best was (39%), and the PBL was (36%) and the lecture method was (25%).

DISCUSSION

A great deal of literature commends PBL, its implementation, its efficacy and records limitations in the clinical setting as well as in regular teaching programs in medical schools.^{11,13,17} New medical students who used the teacher-centered curriculum in pre-university education may find it difficult to adjust to the environment of a medical school which has a PBL, student-centered curriculum. The one-way lecture style of teaching is at variance with the innovative principles of medical education and does not produce life-long learners. On the other hand, a meta-analysis does not simply advocate the organization of students into small groups for medical education,¹⁸ but suggests that a greater amount of time should be spent by students in active, meaningful learning and thinking processes. Teachers continue to indicate that these approaches engage the minds of the students, motivate them and improve their comprehension of course materials.⁷

We intended to investigate the merits of an alternative instructional method without the

Table 2: Comparison of medical students' means scores of the three teaching methods at the initial assessment

Evaluation type	Teaching Methods			F-value	p-value
	Lectures Mean (SD)	Modified Mean (SD)	PBL Mean (SD)		
MCQ	7.68 (2.2)	7.8 (1.9)	6.8 (2.2)	1.90	0.155
Short answer	5.94 (2.6)*	7.3 (1.9)	8.6 (1.2)*	13.93	<0.0001
MEQ	6.30 (1.8)*	6.7 (1.8)	7.8 (1.5)*	6.45	0.002

*Significantly different with each other (by Duncan's Multiple Range Test)

Table 3: Comparison of medical students' means scores of the three teaching methods at the second assessment

Evaluation type	Teaching Methods			F-value	p-value
	Lectures Mean (SD)	Modified Mean (SD)	PBL Mean (SD)		
MCQ	6.8 (2.2)	7.3 (2.0)	6.3 (1.9)	1.75	0.18
Short answer	4.7 (2.2)*	6.0 (2.6)	7.0 (2.1)*	6.8	0.002
MEQ	5.7 (1.4)	5.7 (2.1)	6.5 (1.8)	1.4	0.238

*Significantly different with each other (by Duncan's Multiple Range Test)

limitations of conventional lectures, but which is more acceptable and cheaper than the PBL method. The suggested alternative method, (modified PBL) is mid-way between PBL and the lecture methods. Therefore, both the staff and students may adjust to this method much more easily than the PBL method. The small number of study subjects makes our results inconclusive and calls for a larger and well-designed study to confirm or refute our findings. Nonetheless, it provided an idea on the performance of the three styles of teaching and students' performances.

Most of the study subjects (75%) favored the PBL and the modified PBL. This would be encouraging to our institute when the adoption of the PBL or hybrid curriculum is under consideration. In the first evaluation, the PBL method was found to be associated with better students' performance compared with the lecture format but not significantly different from the modified PBL. However, the second assessment indicated a decline in the total score and the mean scores of MCQs and MEQs. Another study conducted on postgraduate training program for mental health had similar results. In that instance, the knowledge of the groups taught by lectures and PBL had increased equally directly after program but decreased equally after follow-up.¹⁹ The difference in the performance scores of knowledge and problem-solving did not remain at the second assessment (after two weeks). However, a significant difference between the three teaching methods remained with regard to the short answer question tests that assessed students' comprehension, an important element in the learning process.¹⁸ The disappearance of the effect two weeks later could be explained by (1) the students' lack of enthusiasm in answering the questions as indicated by the decline in the scores of oral questions, (2) the small number of study subjects, (3) the cross contamination of the students, (4) and their ability to control other influencing factors, which might have led to the biases of Hawthorne and John-Henry, (5) the use of context-free MCQ's (the clinical scenario) are not the preferred choice for testing the application of knowledge or problem-solving skills and (6) the instrument's validity and reliability were not assessed.

The findings of this preliminary study with a small sample size suggest that the modified PBL

should be tested in larger studies, to confirm or refute our findings.

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Multiple Choice Questions:-

Q1. In ankylosing spondylitis which of the following is TRUE:

- a. The first symptom is always low back pain.
- b. Affects females more than males.
- c. The onset is in the middle age (40-60 years)
- d. The joints are usually freely mobile in the morning but stiff as the time goes by.
- e. About 80% of the affected patients have a positive titre for HLA B27.

Q2. The following disease or illness rarely presents as backache:

- a. Carcinoma of the prostate.
- b. Spinal stenosis.
- c. Anxiety.
- d. Rheumatoid arthritis.
- e. Osteoporosis.

Short Answers:-

Q1. Recognized contributory factors to chronic backache include (mention three).

- 1. _____
- 2. _____
- 3. _____

MEQ Ali's back pain.

Ali, a 35-year-old teacher presented with a one-week history of low back pain that increases in the evening and after activity. The pain is deep dull aching and radiates to the left lower limb.

On examination you noticed that Ali is rather unhappy. There was tenderness on the left side at level L4/L5/S1. SLR test is limited at 60° whereas the slump test is -ve.

Neurological examination (sensation, power, reflex) is negative.

Q1. What is your assessment of Ali's condition? What are the differences from the other likely diagnoses?

Q2. How would you handle the consultation? What actions would you undertake? (Be specific).